fact that eggs of apogamous forms may produce staminate as well as ovulate plants does not affect the problem, since such eggs are diploid, and the sex tendencies have not yet been separated. The case is similar to that of budding.

A cytological study was made in *Melandrium rubrum*, *Cannabis sativa*, and *Mercurialis annua*, but at present no cytological features have been recognized which seem to have any bearing upon the problem of the separation of the sexes. In *Melandrium rubrum* one chromosome is constantly larger than the others, as was noted during the reduction divisions and in vegetative cells, but it could not be connected with sex differentiation.

The problem is unusually large and difficult, and the present paper suggests many points of attack.—CHARLES J. CHAMBERLAIN.

Crown gall.—The most noteworthy contribution recently made to plant pathology is the bulletin on crown gall of plants by SMITH, BROWN, and TOWNSEND.[13] This disease, on account of its wide distribution and the conspicuous nature of the deformations to which it owes its name, has long attracted the attention both of practical horticulturists and plant pathologists. Yet, with the exception of the work of some Italian investigators, little has been done to work out the etiology of the disease. From general observations it has been believed that the disease is communicable, and one investigator (CAVARA) isolated an organism from a gall of the European grape and established a strong probability that it was the causal organism of that particular gall. The nature of the outgrowths known as crown gall and occurring on a great many different kinds of plants, the cause of their occurrence, and the relation of the crown galls of different plants to each other, have remained among the most obscure problems in the whole field of plant pathology. The results of investigations on these problems are reported in the present bulletin.

The work begins with a short historical sketch of the more important investigations on the crown gall, special emphasis being laid on the work of Italian investigators who first ascribed the disease to bacteria. This is followed by an account of the isolation of the causal organism, and the evidence showing that the crown gall of various plants is due to bacterial organisms; and that these belong either to a single species or to closely related species or strains, each of which can be inoculated into many species of plants. The morphology and cultural characteristics of the organism (*Bacterium tumefaciens* Smith and Townsend) are described at length. Further, the similarity between crown gall and some animal tumors is discussed. This similarity is emphasized by the occurrence of metastases in infected plants. The last part of the bulletin relates to the practical aspects of the subject, together with a statement of the plants infected and their distribution. The evidence given in the first part is supported by 36 excellent plates.

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[13] SMITH, E. F., BROWN, NELLIE A., TOWNSEND, C. O., Crown gall of plants; its cause and remedy. Bur. Pl. Ind. Bull. **213**: pp. 200. *pls.* 36. *figs.* 3. 1911.

It may be said that the beginning of the present work dates back to the discovery of gall-like outgrowths on the stems of the Paris daisy (*Chrysanthemum frutescens*) in 1904. It was not until 1906, after many unsuccessful trials, that an organism was isolated which when inoculated into sound plants caused the growth of galls similar to the ones from which the organism had been obtained. The organism was inoculated from pure cultures into many different plants, several hundred inoculations having been made. The results showed that on nearly all herbaceous plants tried, such as daisy, pyrethrum, tobacco, clover, cotton, sugar beet, hop, and others, galls were produced as a result of the inoculations. Inoculations into such woody plants as rose, grape, almond, poplar, and Persian walnut also gave galls, but with less frequency than the herbaceous plants. Inoculations on a number of other plants did not result in the formation of galls, although in some instances inoculations had been successful in other experiments with the same plants. Later, crown gall organisms were isolated from a large number of other plants, both woody and herbaceous, including the common nursery trees, as apple, peach, and poplar, which suffer most seriously from the crown gall, and such organisms were also capable of infecting a number of hosts besides the original one. The "hairy root" of apple, which has been more or less associated with crown gall in the minds of nurserymen, was found to be due to the same organism which when inoculated into other plants, as the sugar beet, for instance, gave galls with the characteristic hairy roots. The vast amount of evidence of this nature presented in the bulletin shows that the crown gall and similar tumors, and the hairy root disease of various plants, are due to bacteria, and that the organism of each kind of plant is capable of being inoculated at least into several other plants. The organisms from different sources, while similar in their general characteristics, show minor cultural differences. This behavior leads the authors to leave undecided the question whether the organisms constitute several species or a single species with several races.

An interesting comparison is made between the crown gall outgrowths and animal tumors to which they show resemblance in growth and organization. This resemblance is carried still farther by the formation by the plant galls of metastases, which occur at some distance from the primary gall, but without the intervention of new infections. It is suggested that the metastases occur as a result of growths from the primary galls.

Another important idea is brought out in a number of experiments which tend to show that plants acquire immunity to the crown gall organism as a result of repeated inoculation. If the result of those experiments should be confirmed by future work, this would be the first instance of immunity in plants analogous to that in animals.

This work has removed from the domain of speculation the cause of crown gall and kindred diseases affecting many plants. These diseases, in all their varied manifestations, are shown to be due to a common cause. The enormous

amount of evidence presented leaves no doubt as to the correctness of the conclusions. Aside from having solved one of the most obscure problems of plant pathology, the authors have shown that it has a more general bearing in showing that these plant galls, due to bacteria, present many analogies to animal tumors. The successful isolation of causal bacteria from the plant tumors, after many failures, leads one to hope that the work will stimulate renewed search for organisms in animal tumors.—H. HASSELBRING.

Coastal floras.—H. CHERMEZON[14] has recently made a contribution to the study of coastal floras. In the introduction he calls attention to the well known peculiarity of these floras, the interest they have excited in botanists since ancient times, and the theories advanced as to the relation between them and salt in the soil.

The main part of the work is divided into three sections. In part 1 is given a description of the structure of the leaf and stem of a large number of plants of the coast, chiefly of France, but also of some of the salt-desert regions of Tunis. In part 2 a study is made of the characters peculiar to plants of the coast. There are three categories of habitat: (1) the region of sands, including (*a*) beaches and (*b*) dunes; (2) region of rocks and cliffs, including (*a*) rocks and bowlders exposed to the spray and (*b*) the top of cliffs; (3) damp salty places including (*a*) muddy flats and salt marshes (the halophytic zone par excellence), and (*b*) damp prairies, not reached by the sea, which form a transition to the flora of the interior.

Part 3 is devoted to a discussion of the flora. It is divided into two parts: (1) marshes, rocks, and beaches; and (2) dunes and sands. The transition between the two is made by the plants of the beaches which have characters common to both. In the first group succulency and development of water-tissues are the striking features, while the second shows more often thickening of the cuticle, sinking of stomata, and abundance of hairs. As the stations of the first group are the most salty, while the dunes are not salty at all, the author distinguishes two sorts of floras, the halophilous and the xerophilous. The xerophilous flora reaches its maximum in the dunes, where the characters are such as are met with in other xerophilous floras; but it is less specialized than that of the desert or even the Mediterranean flora, since the dryness is less pronounced and less continuous. The halophilous flora occupies the beaches, the rocks and bowlders, and the salt marshes. The beach and the dunes are not distinct, plants passing from one to the other; but a great many sand-loving plants of the dunes are absent from the beach, which the author explains by the presence of salt, small in amount but sufficient to eliminate them. The rocks and bowlders in the vicinity of the sea, exposed to the spray, are occupied by a flora with special characters, less halophilous than those of

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[14] CHERMEZON, H., Recherches anatomiques sur les plantes littorales. Ann. Sci. Nat. Bot. **12**:117–313. *figs.* 52. 1910.